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A Note on Inflation Persistence

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No 07	By Jon Vislie: ENVIRONMENTAL REGULATION, ASYMMETRIC INFORMATION AND FOREIGN OWNERSHIP. 27 p.
No 06	By Erik Biørn: HOW IS GENERALIZED LEAST SQUARES RELATED TO WITHIN AND BETWEEN ESTIMATORS IN UNBALANCED PANEL DATA? 6 p.
No 05	By Atle Seierstad: NECESSARY CONDITIONS AND SUFFICIENT CONDITIONS FOR OPTIMAL CONTROL OF PIECEWISE DETERMINISTIC CONTROL SYSTEMS. 39 p.
No 04	By Pål Longva: Out-Migration of Immigrants: Implications for Assimilation Analysis. 48 p.
No 03	By Øystein Kravdal: The Importance of Education for Fertility in Sub-Saharan Africa is Substantially Underestimated When Community Effects are Ignored. 33 p.
No 02	By Geir B. Asheim and Martin L. Weitzman: DOES NNP GROWTH INDICATE WELFARE IMPROVEMENT? 8 p.
No 01	By Tore Schweder and Nils Lid Hjort: Confidence and Likelihood. 35 p.
No 43	By Mads Greaker: Strategic Environmental Policy when the Governments are Threatened by Relocation. 22 p.
No 42	By Øystein Kravdal: The Impact of Individual and Aggregate Unemployment on Fertility in Norway. 36 p.

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by

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Abstract

In an important paper, Fuhrer and Moore (1995) showed that Taylor (1980)'s staggered wage setting model does not exhibit persistence in inflation; they proposed a simple modification, in which workers cared about the real wages of other workers, which solves this problem. However, we argue that the key part of Fuhrer and Moore's model is not that workers care about the real wages of other workers, but that workers are assumed to care about the *past* real wages of other workers. When that assumption is replaced by the assumption that workers care about current real wages of other workers, the Fuhrer and Moore model reverts identically to the Taylor model. We also show that a simple model in which workers care about their own past real wages, e.g. because unemployment insurance depends on past wages, as noted in Blanchard and Katz (1999), generates *negative* autocorrelations in inflation.

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In an important paper, Fuhrer and Moore (1995) showed that the standard formulation of staggered wage setting due to Taylor (1980) implied price stickiness, but not inflation stickiness. Fuhrer and Moore proposed a new formulation, which they referred to as the relative contracting model, which exhibits persistence in inflation. Fuhrer and Moore then showed that the relative contracting model is consistent with US macroeconomic data for inflation and output, while the standard contracting model of Taylor is resoundingly rejected.

Fuhrer and Moore made important points by showing the empirical weakness of the Taylor model, and by proposing a simple resolution to the problem with a seemingly reasonable justification. The model they proposed has been widely used in the literature and in popular graduate text books (e.g. Walsh (1998), pp. 224-225, 460-467, 472-474, and Romer (2001) pp. 295-296), as it is a convenient analytical representation that fits the data. However, finding a formulation that is both empirically and theoretically satisfying is harder than what one may infer from Fuhrer and Moore. As a justification for their new model, Fuhrer and Moore argue that agents care about relative real wages, and not about nominal wages. In this note, we will argue that this motivation is misleading. Fuhrer and Moore's model is based on agents caring about the real wages that other workers obtained in the past. If Fuhrer and Moore's model were modified so that workers cared about the contemporaneous real wages of other workers, which is arguably the more

reasonable assumption, then the model coincides with the standard formulation of Taylor (1980).[1]

Fuhrer and Moore's work may lead one to think that inflation persistence may alternatively be generated by agents caring about their own past wages, which seems more realistic than comparing with the past wages of others. Indeed, this is the idea of Blanchard and Katz (1999, p. 73), who suggest "that taking into account the dependence of the reservation wage on past wages holds a key to understanding the dependence of inflation on itself lagged." While not doing any formal representation of this point, Blanchard and Katz refer among other things to that fact that unemployment benefits institutionally depend on previous wages, suggesting that reservation wages will move with lagged wages. We propose two alternative representations of their idea, and show that in contrast to the presumption by Blanchard and Katz (1999), this idea leads to negative autocorrelation of inflation.

The Fuhrer and Moore model

Consider the two-period framework used by Taylor (1980) and Fuhrer and Moore (1995). Wages are set in contracts lasting for two periods. Contracts are staggered, so that half of the contracts are set in each period. Let x_t denote the log of the contract wage set in

[1] This paper is not the first that questions the microfoundations of Fuhrer and Moore (1995); c.f. Roberts (1998) and Taylor (1999). However, their arguments are different from ours. Roberts' criticism is that the model implies agents "are concerned about having a large change in their nominal wage relative to inflation when employment is high. Hence, the Fuhrer and Moore model "slips a derivative" relative to the conventional microeconomics". Taylor argues that the wage should be related to the price level over the full contract period, a point already acknowledged by Fuhrer and Moore in their appendix B.

period t. Prices are a constant unit markup over wages so that the log of the price index in period t, p_t, is the average of the contract wages negotiated in period t and period t-1.

(1) $p_t = ½ (x_t + x_{t-1})$.

Taylor (1980) assumed that contract wages are set as a average of the lagged and the expected future wage contracts, adjusted for excess demand y_t.

(2) $x_t = ½ (x_{t-1} + E_t x_{t+1}) + k y_t$ $\quad k > 0$.

Using (1) and (2), we obtain

(3) $p_t = ½ (p_{t-1} + E_t p_{t+1}) + (k/2) (y_t + y_{t-1})$.

Defining the rate of inflation $\pi_t = p_t - p_{t-1}$, and rearranging equation (3),

(4) $\pi_t = E_t \pi_{t+1} + k(y_t + y_{t-1})$

Thus, as emphasized by Fuhrer and Moore (1995), in the Taylor model any persistence in π_t must derive from persistence in y_t. In contrast, Fuhrer and Moore propose a new contracting formulation where "agents care about relative real wages over the life of the wage contract." They propose a contracting equation of the form

(5) $x_t - p_t = ½ (x_{t-1} - p_{t-1} + E_t(x_{t+1} - p_{t+1})) + ky_t$.

Substituting the definition of x_t in equation (5) into the price index equation (1), yields

(6) $\pi_t = ½ (\pi_{t-1} + E_t\pi_{t+1}) + (k/2) (y_t + y_{t-1})$.

To justify their model, Fuhrer and Moore (page 131) argue that "In the relative wage specification, however, agents compare the real value of their wage contracts with the real value of wage contracts previously negotiated and still in effect, and with contracts expected to be negotiated over the duration of the contract period, equation (5). We suggest that it is a priori more plausible that agents care more about the price-level-adjusted value of their neighboring wage contracts than their nominal value."

However, this justification is misleading. Presumably, the most natural interpretation of "the real value of wage contracts previously negotiated that are still in effect" is $x_{t-1} – p_t$, i.e. the nominal wages set in the previous period evaluated at current prices. In contrast, according to (5), agents care about $x_{t-1} – p_{t-1}$, that is, the real wages that the other group of workers had in the previous period.[2]

A further point is that the assumption implicit in (5) is also difficult to defend theoretically. It is not difficult to explain why agents may compare their own real wage with the real wage that other groups obtain at the same time, and many other studies make this assumption (eg Bhaskar, 1990). However, it is harder to understand why

[2] Later in the paper, Fuhrer and Moore note (p. 141) that defining preferences over $x_{t-1} – p_{t-1}$ is "a convenient simplification".

workers should compare their own real wage with the real wage other groups had last period.

To explore the consequences of the more reasonable assumption, that workers care about the real wage other groups obtain at the same time, we substitute $x_{t-1} - p_t$ for $x_{t-1} - p_{t-1}$ in (5). Furthermore, we also make the theoretically preferable assumption that the real wage to be determined is the expected real wage over the contract period, and not the real wage in the first period of the contract period (as also argued by Fuhrer and Moore, 1995, in their appendix B). Thus, we substitute $x_t - ½(p_t + E_t p_{t+1})$ for $x_t - p_t$ on the RHS of (5)[3], to obtain

$$(7) \qquad x_t - ½(p_t + E_t p_{t+1}) = ½ (x_{t-1} - p_t + E_t(x_{t+1} - p_{t+1})) + ky_t.$$

However, it is immediate that (7) can be simplified to (2), that is, the standard framework of Taylor (1980). Thus, the crucial feature of the model of Fuhrer and Moore is not that agents care about relative real wages; indeed, the standard formulation of Taylor is consistent with that. The crucial feature of the model of Fuhrer and Moore is that agents are assumed to care about the real wages that other groups had in the previous period, which is an assumption that is harder to justify.

Effect of past wages

From Fuhrer and Moore's formulation one might also expect inflation persistence to be generated if workers cared about their own past wages, and this is indeed the conjecture of Blanchard and Katz (1999). One can think of various ways in which past wages may

affect the wage setting. Blanchard and Katz refer to the fact that unemployment benefits depend on past wages. In a bargaining setting, the outcome might then depend on past wages, via the effect of the unemployment benefits, as well as on the expected real wages of other workers. Observe however that benefits are linked to past nominal wages, while the real value depends on current prices. Thus, workers that negotiate in period t had their past wages negotiated in period t-2, implying that real benefits depend on $x_{t-2} - p_t$. Extending the Taylor formulation to include this aspect suggests a formulation as follows (where $0 < \gamma < 1$)

$$(8) \qquad x_t - \frac{1}{2}(p_t + E_t p_{t+1}) = \gamma(x_{t-2} - p_t) + \frac{1-\gamma}{2}\left(x_{t-1} - p_t + E_t[x_{t+1} - p_{t+1}]\right) + ky_t \,.$$

Substituting (1) in (8) and rearranging yield

$$(9) \qquad \frac{2+\gamma}{4}\Delta x_t = -\gamma\Delta x_{t-1} + \frac{2-\gamma}{4}E_t\Delta x_{t+1} + ky_t \,.$$

First difference (1) to obtain:

$$(10) \qquad \pi_t \equiv \Delta p_t = \frac{1}{2}\left(\Delta x_t + \Delta x_{t-1}\right).$$

Using the definition of π_t from (10) in (9), we obtain

[3] Retaining $x_t - p_t$ would not change the conclusion qualitatively.

(11) $$\Delta x_t = -\gamma \Delta x_{t-1} + \frac{2-\gamma}{2} E_t \pi_{t+1} + y_t \, .$$

Using (10) and (11), we obtain

(12) $$\pi_t = -\gamma \pi_{t-1} + \frac{2-\gamma}{4} \left(E_t \pi_{t+1} + E_{t-1} \pi_t \right) + \frac{k}{2} \left(y_t + y_{t-1} \right).$$

Thus, this variant displays negative autocorrelation of inflation, the opposite of the inflation persistence evident in data.[4] The intuition for the negative effect is that high inflation in period t-1 reduces the real value of the workers' benefits', and thus weakens workers' bargaining position. This dampens wage growth in period t, and consequently lowers period t inflation.

Past wages may also affect wage setting if workers' aspirations in job search and wage bargaining are shaped by their previous earnings, as also suggested by Blanchard and Katz (1999). One justification for this, proposed by Ellingsen and Holden (1998), is that past expectations may affect wage setting via workers' choice of durable consumption goods. To see whether this idea may explain inflation persistence, consider a formulation where the wage outcome depends on the real wages that the workers had in the previous period, $x_{t-2} - p_{t-1}$, as well as on the expected wages of other workers:

[4] One can show that the first autocorrelation of inflation remains even if one solves out for the expected inflation terms.

(13) $$x_t - \frac{1}{2}(p_t + E_t p_{t+1}) = \gamma(x_{t-2} - p_{t-1}) + \frac{1-\gamma}{2}\left(x_{t-1} - p_t + E_t[x_{t+1} - p_{t+1}]\right) + ky_t$$

Substituting (1) in (13) and rearranging yield

(14) $$\frac{2-\gamma}{4}\Delta x_t = -\frac{\gamma}{2}\Delta x_{t-1} + \frac{2-\gamma}{4}E_t\Delta x_{t+1} + ky_t\,.$$

Using (10), (14) can be further rearranged to

(15) $$\Delta x_t = -\frac{\gamma}{2-\gamma}\Delta x_{t-1} + E_t\pi_{t+1} + \frac{2k}{2-\gamma}y_t\,.$$

Using (10) and (15), we obtain

(16) $$\pi_t = -\frac{\gamma}{2-\gamma}\pi_{t-1} + \frac{1}{2}\left(E_t\pi_{t+1} + E_{t-1}\pi_t\right) + \frac{k}{2-\gamma}\left(y_t + y_{t-1}\right).$$

Again, we find negative autocorrelation of inflation, the opposite of the inflation persistence evident in data.

Conclusions

It is very difficult to generate inflation persistence (i.e. positive autocorrelations of inflation) in forward-looking contract model. Taylor's original model generates no autocorrelation in inflation. Fuhrer and Moore (1995)'s generates positive autocorrelation. As this note argues, it does so by assuming that workers care about the

past real wages of other workers. Once one replaces their formulation with the arguably more reasonable assumption that workers care about the current real wages of other workers, the resulting formulation immediately reduces to that of Taylor. We also show that if workers care about their own past wages, either because unemployment insurance is related to own past wages or because the past real wage has a more direct effect, this yields negatively autocorrelated inflation, the opposite of the empirical regularity.

This leaves open the question of how to generate inflation persistence in contracting models. Recently, several different alternative types of explanations have been proposed. Roberts (1998) and Ball (2000) have suggested models that relax the assumption that expectations are rational. Jadresic (2000) proposes a staggered price-setting model with a flexible distribution of price durations. Mankiw and Reis (2001) argue that information about macroeconomic conditions diffuses slowly through the economy. In a companion paper (Driscoll and Holden, 2001), we show that inflation persistence may be caused by coordination problems associated with workers being concerned about fair treatment, in the sense that they care disproportionately more about being paid less than other workers than they do about being paid more.

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